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Condensation of Wet Vapors in Turbines

The problem:

Assessment of the erosion potential of wet vapor turbines requires a detailed picture of the formation and transport of particles within blade passages. The principal source of this moisture is generally the process of spontaneous condensation. It is particularly important to locate the Wilson line physically, and to then estimate, as a function of position within the machine, the size and quantity of the drops thus formed.

The solution:

A computer program has been developed to predict the condensation point in wet vapor turbines and to analyze the subsequent nucleation and growth processes to determine both the moisture content and the drop size and number distribution as a function of position.

How it's done:

The approach, which is similar to that first developed by Oswatitish, consists of the simultaneous solution of the continuity, energy, momentum, and state equations written for the turbine geometry. The nucleation theory of Katz, Saltsburg, and Reiss is the basis for the treatment of condensation where associating vapors are involved. Estimates are also made of the quantity of moisture condensed on blade and casing surfaces.

Two important features of the program are the inclusion of the effects of molecular association on the condensation and flow processes and the capability to handle both subsonic and supersonic flows. Temperature-dependent thermodynamic and transport properties are generated internally by the program, under input control, permitting a variety of working fluids to be specified. Steam, potassium, cesium, and mercury vapor turbines have been examined using this tool.

Notes:

1. This program is written in ALGOL for use on the Burroughs B-5500 computer.
2. Inquiries may be directed to:
COSMIC
Barrow Hall
University of Georgia
Athens, Georgia 30601
Reference: B70-10613

Source: R. E. Kothman of
Westinghouse Astronuclear Lab.
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